300mA Output,Low noise,Low-Dropout CMOS Linear Regulator

General Description

The LP3981 series low-dropout, low-power regulators offer a fast start-up and excellent line and load transient responses. A low ground current while at no load with chips enabled makes the devices attractive for battery-operate power systems. The LP3981 series also provides an active pull-down circuit to quickly discharge output load. Other features include short current limit, thermal protection and a low current consume shut-down mode.

The LP3981 is available in SOT23-5 / SOT23 / DFN-4(1mm*1mm) / DFN-6(2mm*2mm) packages.

Order Information

LP3981 -□□ □□ □

- F: Pb-Free
- Package Type
  - B3 : SOT23
  - B5 : SOT23-5
  - QV : TDFN-4(1mm*1mm)
- Output Voltage
  - A : Voltage Adjstable
  - 12 : 1.2V
  - 13 : 1.3V
  - 15 : 1.5V
  - 18 : 1.8V
  - 25 : 2.5V
  - 28 : 2.8V
  - 30 : 3.0V
  - 33 : 3.3V

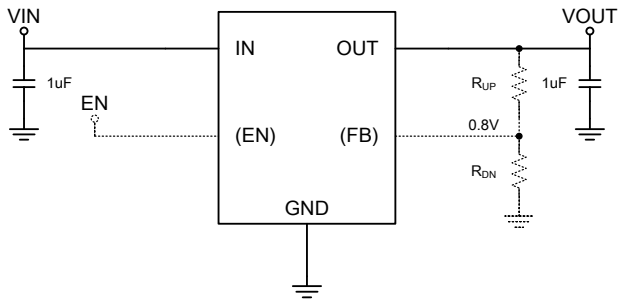
Features

- 2.5V~5.5V Input Voltage Range
- Low Dropout: 260mV @ 300mA
- 300mA Output Current, 500mA Peak Current
- High PSRR: -63dB at 1KHz
- <0.1uA Standby Current In Shutdown Mode
- TTL-Logic-Controlled Shutdown Input
- Ultra-Fast Response in Line/Load transient
- Current Limit and Thermal Shutdown Protection

Applications

- Portable Media Players/MP3 players
- Cellular and Smart mobile phone
- LCD
- DSC Sensor
- Wireless Card

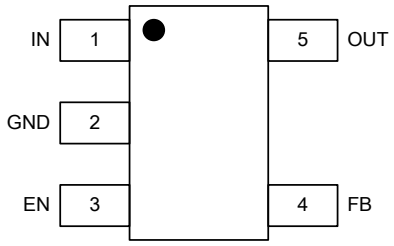
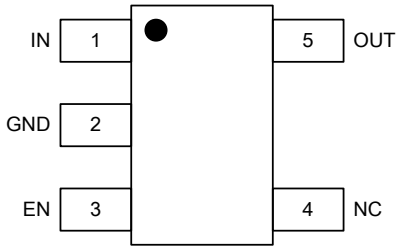
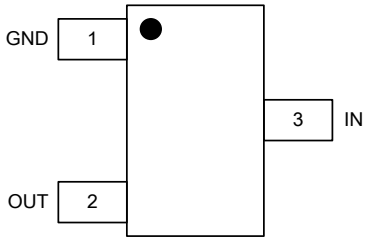
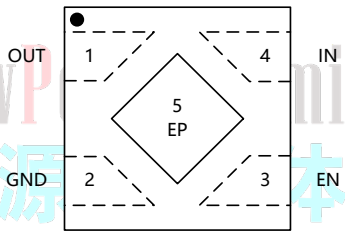
Typical Application Circuit



Marking Information

Device	Marking	Package	Shipping
LP3981-12B5F	LPS 1BYWX	SOT23-5	3K/REEL
LP3981-18B5F	LPS 1CYWX	SOT23-5	3K/REEL
LP3981-25B5F	LPS 1DYWX	SOT23-5	3K/REEL
LP3981-28B5F	LPS 1HYWX	SOT23-5	3K/REEL
LP3981-30B5F	LPS 1GYWX	SOT23-5	3K/REEL
LP3981-33B5F	LPS 1EYWX	SOT23-5	3K/REEL
LP3981AB5F	LPS 1AYWX	SOT23-5	3K/REEL
LP3981-12B3F	LPS 1BYWX	SOT23	3K/REEL
LP3981-18B3F	LPS 1CYWX	SOT23	3K/REEL
LP3981-25B3F	LPS 1DYWX	SOT23	3K/REEL
LP3981-28B3F	LPS 1HYWX	SOT23	3K/REEL
LP3981-30B3F	LPS 1GYWX	SOT23	3K/REEL
LP3981-33B3F	LPS 1EYWX	SOT23	3K/REEL
LP3981-12QVF	BWX	TDFN-4 (1mm*1mm)	12K/REEL
LP3981-15QVF	PWX	TDFN-4 (1mm*1mm)	12K/REEL
LP3981-18QVF	CWX	TDFN-4 (1mm*1mm)	12K/REEL
LP3981-28QVF	HWX	TDFN-4 (1mm*1mm)	12K/REEL
LP3981-30QVF	GWX	TDFN-4 (1mm*1mm)	12K/REEL
LP3981-33QVF	EWX	TDFN-4 (1mm*1mm)	12K/REEL
Y: Year code. W: Week code. X: series numbers			

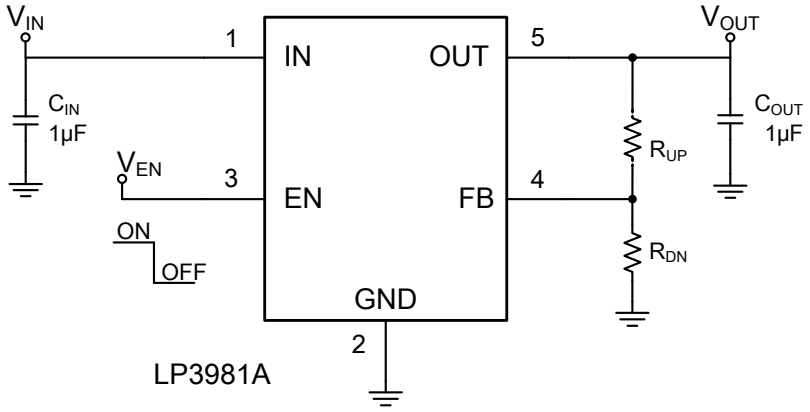
Pin Descriptions

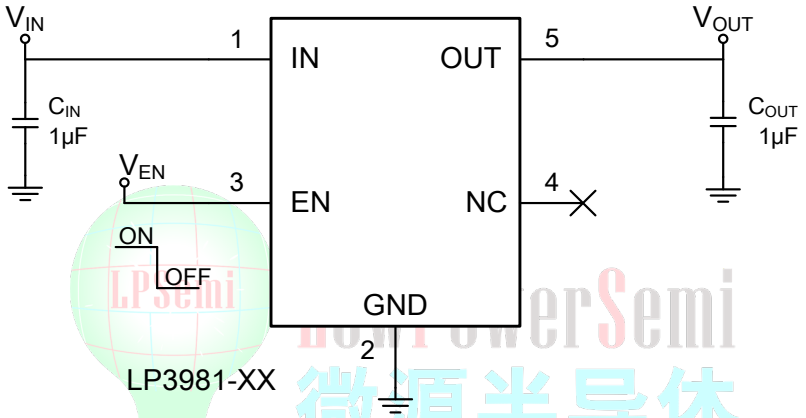
Package Type	Pin Configurations	
	LP3981A	LP3981XX
SOT23-5		
SOT23		
DFN	 TDFN-4(1mm*1mm) (Top View)	

Pin Description

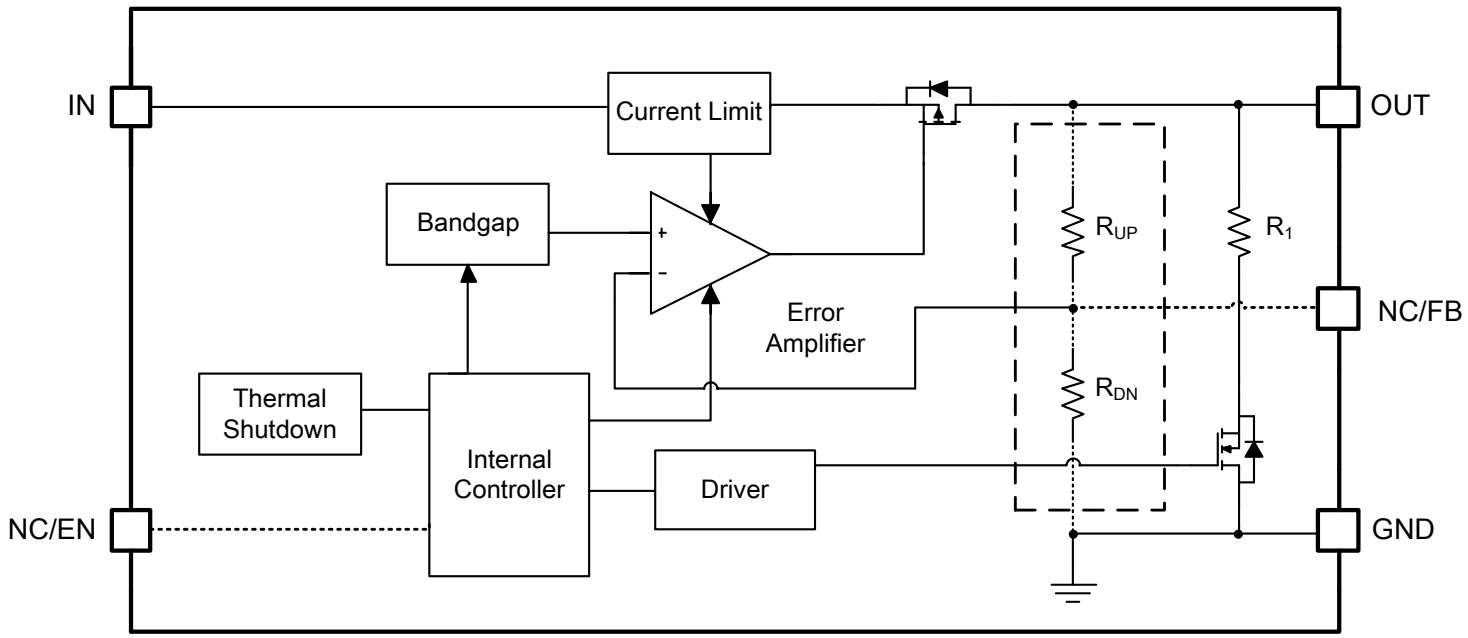
Name	Pin			Description
	SOT23	SOT23-5	TDFN-4	
IN	3	1	4	Power Supply Pin.
GND	1	2	2	Ground.
EN	--	3	4	Chip Enable (Active High). Note that this pin is high impedance. There should be a pull low 100kΩ resistor connected to GND when the control signal is floating.
FB	--	4	--	Feedback Pin The Reference Voltage is 0.8V
NC				No Connect
OUT	2	5	1	Output Pin.

Typical Application Circuit Part B





Functional Block Diagram



Absolute Maximum Ratings

- Supply Input Voltage ---------- -0.3V to 6V
- Other Pins Voltage ---------- -0.3V to 6V
- Power Dissipation, P_D @ T_A=25℃ SOT23-5 ---------- 400mW
- Package Thermal Resistance SOT23-5, θ_{JA} ---------- 250℃/W
- Lead Temperature (Soldering, 10 sec.) ---------- 260℃
- Storage Temperature Range ---------- −60℃ to 125℃

ESD Susceptibility

- HBM (Human Body Model) ---------- 2KV
- MM(Machine-Model) ---------- 200V

Recommended Operating Conditions

- Supply Input Voltage ---------- 2.5V to 5.5V
- EN Input Voltage ---------- 0V to 5.5V
- Operation Junction Temperature Range ---------- -40℃ to 125℃
- Operation Ambient Temperature Range ---------- −40℃ to 85℃

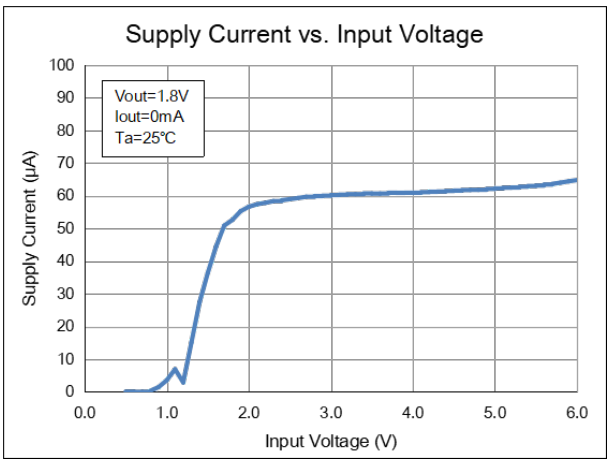
Electrical Characteristics

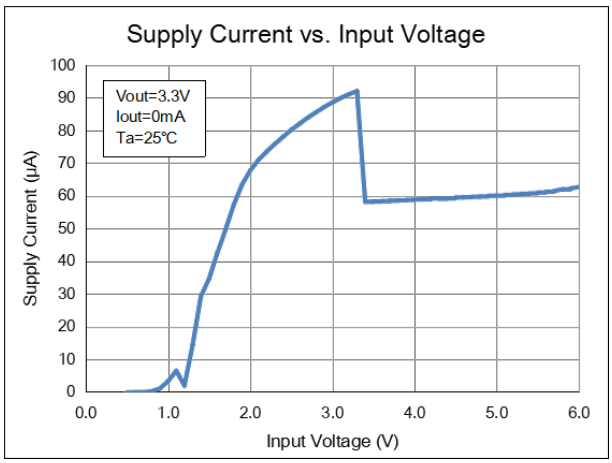
(V_{IN}=V_{OUT} + 1V, C_{IN}=C_{OUT}=1uF, T_A=25℃, unless otherwise specified)

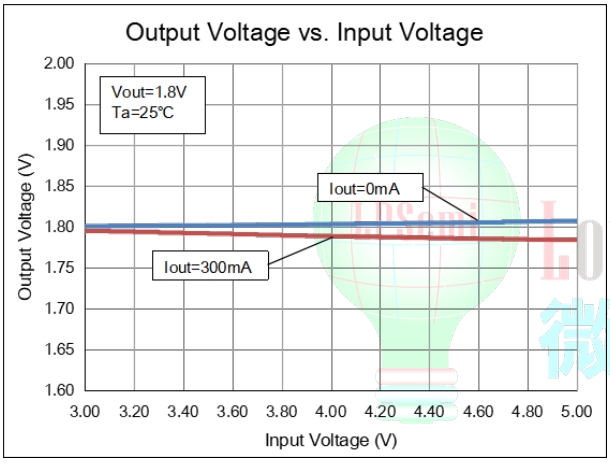
Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage Accuracy		ΔV_{OUT}	I_{OUT}=1mA	−2	--	+2	%
Maximum Output Current		I_{max}	V_{IN}>2.8V		300		mA
Current Limit		I_{LIM}	R_{LOAD}=1Ω	450	550		mA
Adjustable voltage reference		V_{FB}	IOUT=1mA		0.8		V
Quiescent Current		I_Q	(V_{OUT}+1V)<V_{IN}<5.5V, V_{OUT}=1.8V		58		μA
			(V_{OUT}+1V)<V_{IN}<5.5V, V_{OUT}=3.3V		62		μA
Dropout Voltage		V_{DROP}	I_{OUT}=300mA, V_{OUT}=1.2V		1400		mV
			I_{OUT}=300mA, V_{OUT}=1.8V		750		mV
			I_{OUT}=300mA, V_{OUT}=2.8V		280		mV
			I_{OUT}=300mA, V_{OUT}=3.3V		260		mV
Line Regulation		$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{OUT}=1.2V, I_{OUT}=1mA, V_{IN}=2.2V to 5.5V			1	%
			V_{OUT}=1.8V, I_{OUT}=1mA, V_{IN}=2.8V to 5.5V			1	%
			V_{OUT}=2.8V, I_{OUT}=1mA, V_{IN}=3.8V to 5.5V			0.5	%
			V_{OUT}=3.3V, I_{OUT}=1mA, V_{IN}=4.3V to 5.5V			0.5	%
Load Regulation		$\frac{\Delta V_{OUT}}{V_{OUT}}$	V_{OUT}=1.2V, I_{OUT}=1mA to 200mA			2	%
			V_{OUT}=1.8V, I_{OUT}=1mA to 200mA			2	%
			V_{OUT}=2.8V, I_{OUT}=1mA to 200mA			1.5	%
Standby Current		I_{STBY}	V_{EN}=0V, Shutdown		0.1	1	μA
EN Input Bias Current		I_{IBSD}	V_{EN}=1V		0.6	2	μA
EN Threshold	Logic-Low Voltage	V_{IL}	V_{IN}=(V_{OUT}+1V) to 5.5V, Shutdown			0.4	V
	Logic-High Voltage	V_{IH}	V_{IN}=(V_{OUT}+1V) to 5.5V, Start-Up	1.4			V
Output Noise Voltage			10Hz to 100kHz, I_{OUT}=200mA		100		μVRMS
Power Supply Rejection Rate	f=1KHz	PSRR	C_{OUT}=1μF, I_{OUT}=50mA, V_{OUT}=1.8V		-64		dB
	f=10kHz				-54		dB
	f=1KHz		C_{OUT}=1μF, I_{OUT}=50mA, V_{OUT}=3.3V		-63		dB
	f=10kHz				-56		dB
Thermal Shutdown Temperature		T_{SD}	I_{OUT}=0.1mA		160		℃

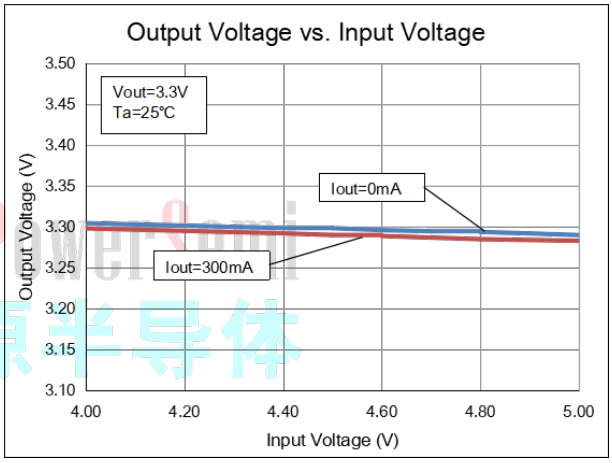
Typical Operating Characteristics

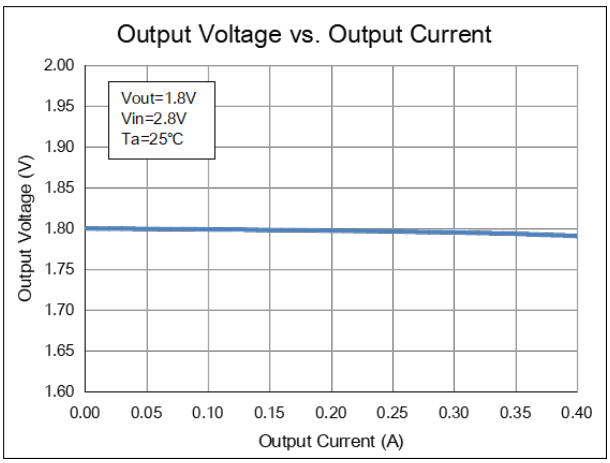
(C_{IN}=C_{OUT}=1uF, T_A=25℃, unless otherwise specified)

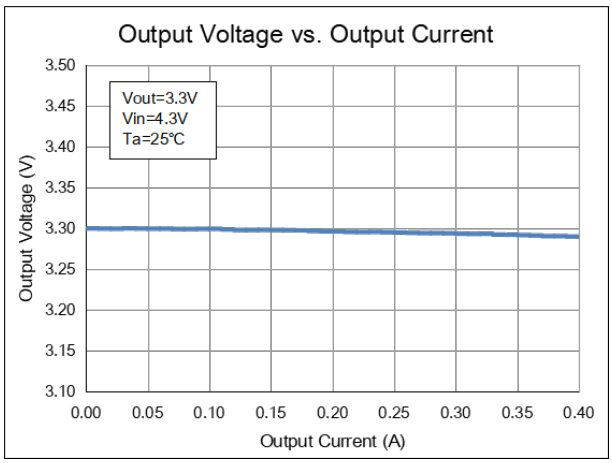






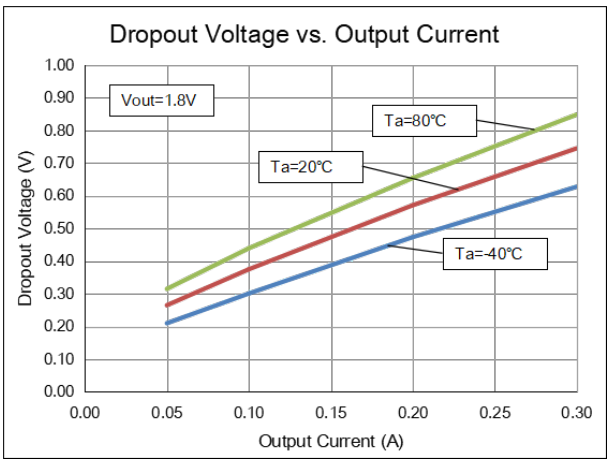


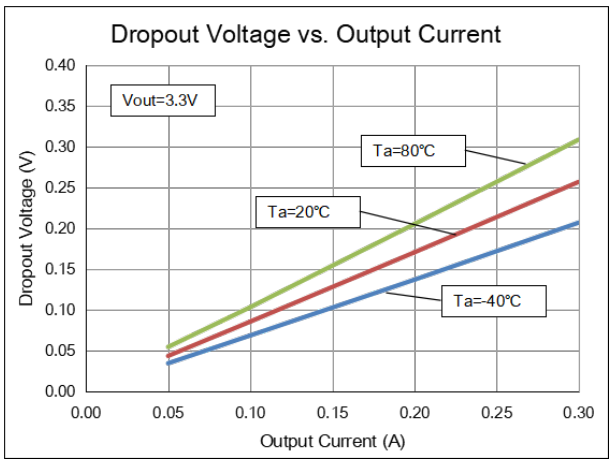


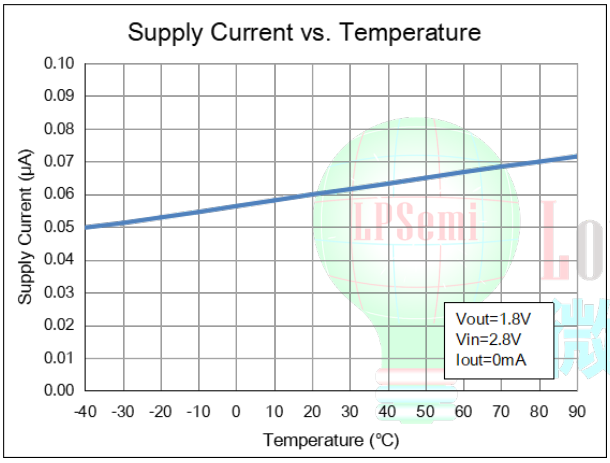


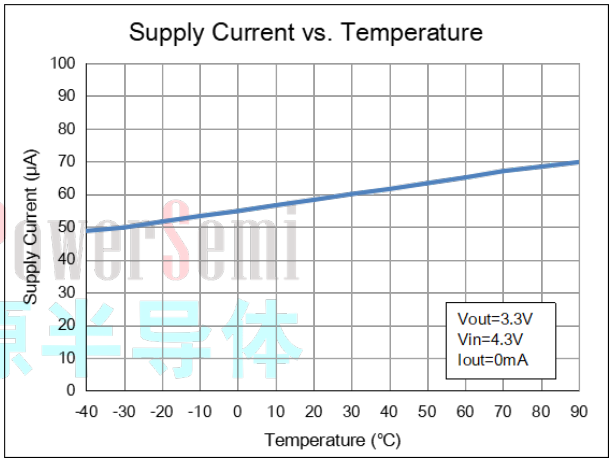
Typical Operating Characteristics

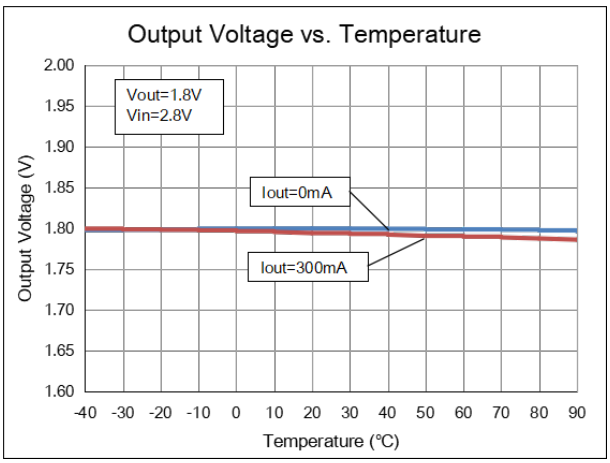
(C_{IN}=C_{OUT}=1uF, T_A=25℃, unless otherwise specified)

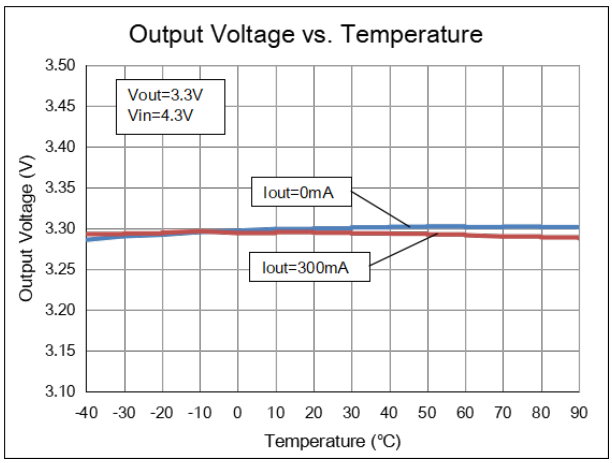






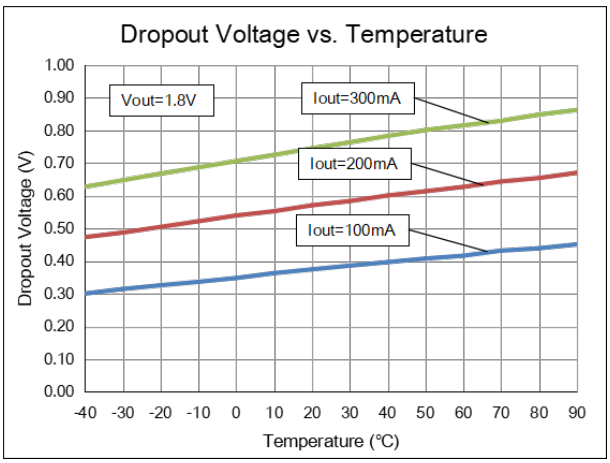


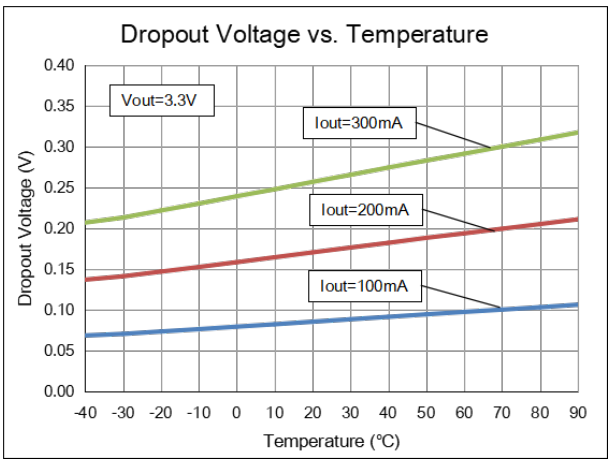




Typical Operating Characteristics

(C_{IN}=C_{OUT}=1uF, T_A=25℃, unless otherwise specified)





Applications Information

The LP3981 series is a low input, low quiescent current and low dropout linear regulator. Additionally, the device contains current limit, soft-start, active pull-down and under-voltage lockout circuit. The internal current limit circuitry protects the device from damage at fault condition. For example, the output of device short to GND or load current is larger than the limited current threshold of the device. During these fault condition, the device sources a fixed amount of current that depends on output voltage. And the internal soft-start circuitry helps protect the supply voltage form the inrush current. The active pull-down circuitry works at which EN pin is in a logic low level, In this case, the voltage of output will decrease.

Under-Voltage Lockout

The LP3981 use an under-voltage lockout circuit. As the input voltage lower than the UVLO threshold voltage (typically 1.5V), the device is turned off. With the input voltage reaches above the UVLO threshold voltage, the device turns the pass elements on.

Start-up Function Enable Function

The LP3981 automatically adjusts the soft-start current to protect input supply from the inrush current, it is approximately equal to the sum of load current and output capacitor charge current.

The enable pin is active high. The internal pass element is turned on when the enable pin voltage is higher than the EN logic high threshold voltage, and the pass element is turned off when the enable pin voltage is lower than the EN logic low threshold voltage. In this case, the device is in an ultralow current shutdown mode.

Set The Output Voltage

For the adjustable version, the reference voltage of the feedback pin is about 0.8V. The feedback resistance PCB circuit is as small and thick as possible to reduce the interference of some circuits. The resistance of the feedback circuit is selected to be less than 10MΩ.The output voltage of LDO can be set as follows:

$$V_{OUT} = V_{FB} \times (R_1/R_2 + 1)$$

Active Discharge

The active pull-down circuit has internal pull-down MOSFET that connect a 120Ω resistor to GND in order to quickly discharge the load. The discharge circuit is active when the EN pin is logic low level and thermal shutdown mode.

Thermal Considerations

When the operation junction temperature exceeds T_{SD}, the OTP circuit turns the pass element off. The pass element turns on again after the junction temperature cools approximately 25℃. For continue operation, do not exceed absolute maximum operation junction temperature 125℃.

The power dissipation definition in device is :

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$$

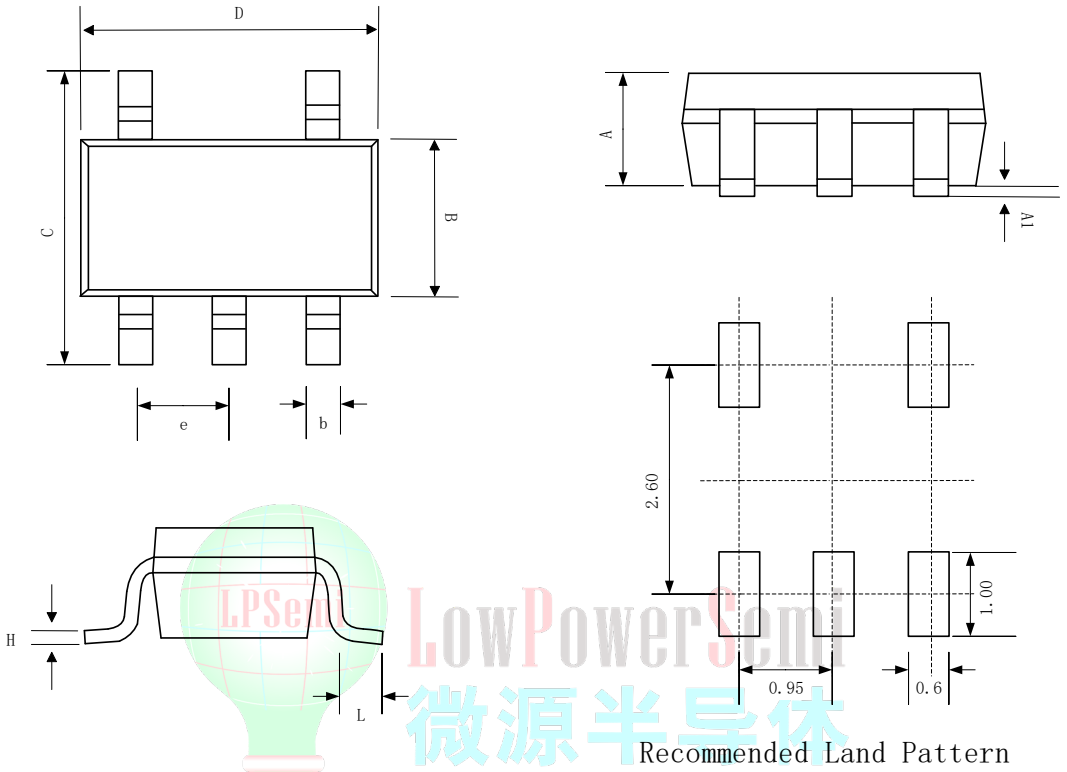
The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient.

The maximum power dissipation can be calculated by following formula:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{\theta_{JA}}$$

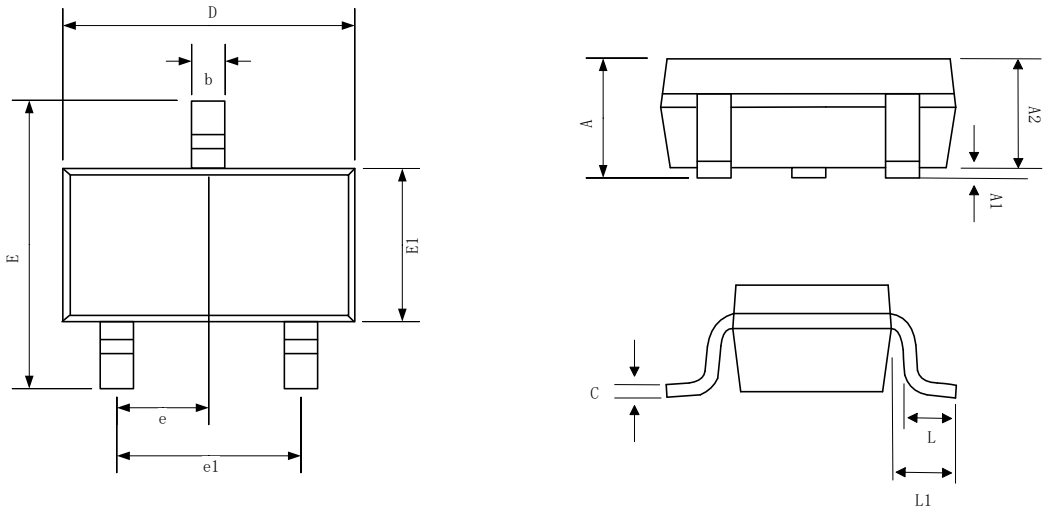
Packaging Information

SOT23-5



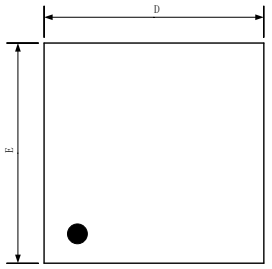
SYMBOL	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.889	1.100	1.295
A1	0.000	0.050	0.152
B	1.397	1.600	1.803
b	0.28	0.35	0.559
C	2.591	2.800	3.000
D	2.692	2.920	3.120
e	0.95BSC		
H	0.080	0.152	0.254
L	0.300	0.450	0.610

SOT23

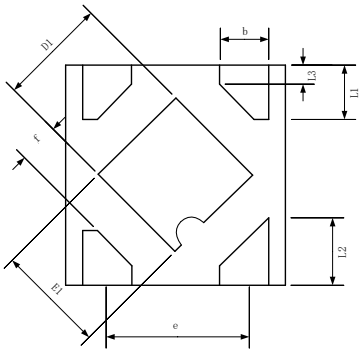


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.900		1.200
A1	0.000	0.050	0.100
A2	0.900	1.000	1.100
b	0.300	0.400	0.500
c	0.008	0.120	0.150
D	2.800	2.900	3.000
E	2.250	2.400	2.550
E1	1.200	1.300	1.400
e	0.950BSC		
e1	1.900BSC		
L	0.200	0.350	0.500
L1	0.600REF		

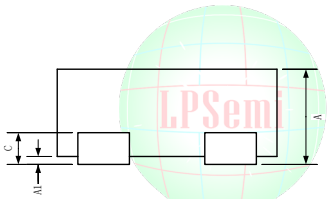
TDFN-4



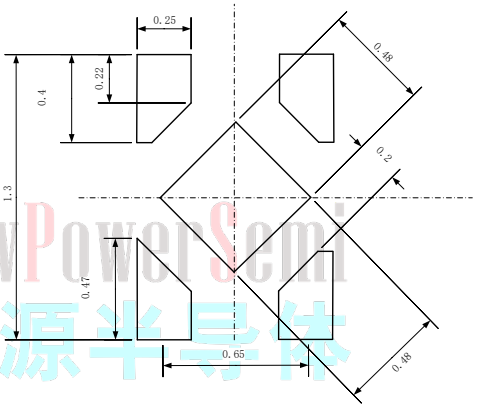
TOP VIEW



BOTTOM VIEW



SIDE VIEW



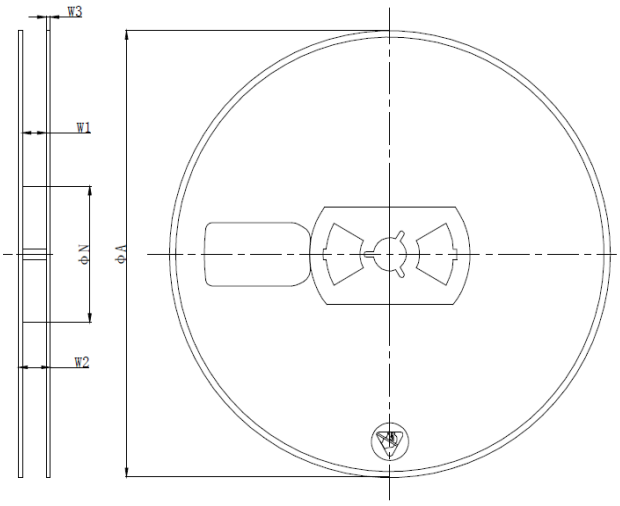
Recommended Land Pattern

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.35	-	0.40
A1	0.00	0.02	0.05
b	0.20	0.25	0.30
c	0.07	0.12	0.17
D	0.95	1.00	1.05
D1	0.43	0.48	0.55
E	0.95	1.00	1.05
E1	0.43	0.48	0.55
e	0.65BSC		
L1	0.2	0.25	0.30
L2	0.27	0.32	0.37
L3	0.09REF		
f	0.18REF		

Tape and Reel Information

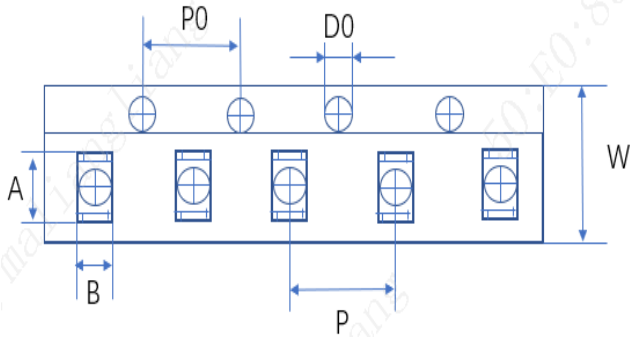
SOT23-5

REEL DIMENSIONS



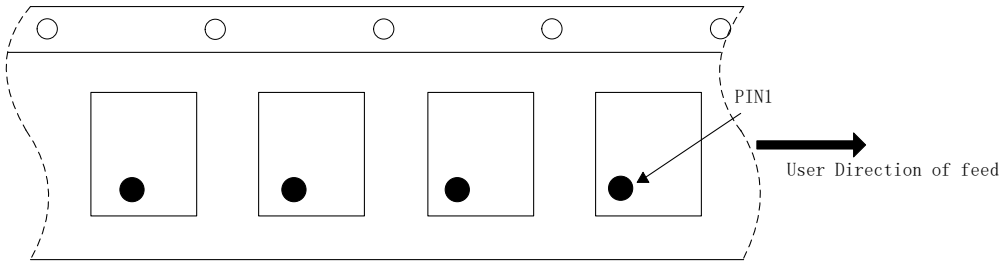
SYMBOL	Dimensions In Millimeters		
	MIN	NOM	MAX
ΦA	176.00	180.00	184.00
W2	10.00	12.00	14.00

TAPE DIMENSIONS



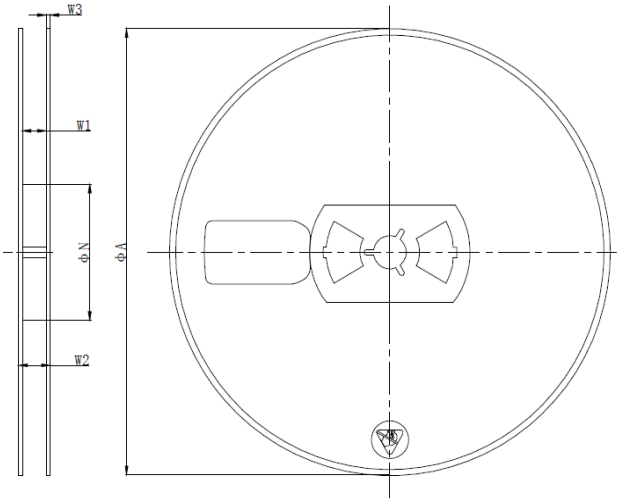
SYMBOL	Dimensions In Millimeters		
	MIN	NOM	MAX
A	3.00	3.20	3.40
B	3.06	3.26	3.46
P0	3.90	4.00	4.10
P	3.90	4.00	4.10
D0	1.35	1.50	1.55
W	7.70	8.00	8.30
C	1.20	1.40	1.60

PIN1 AND TAPE FEEDING DIRECTION



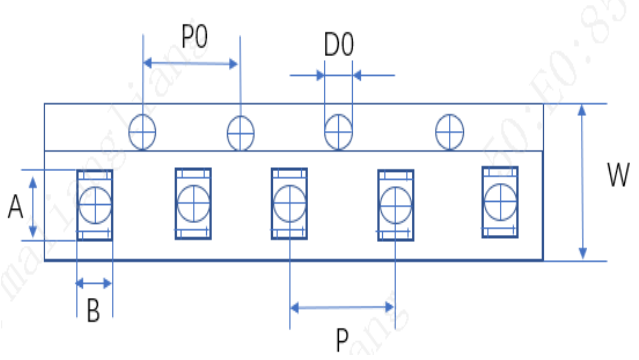
DFN-4

REEL DIMENSIONS



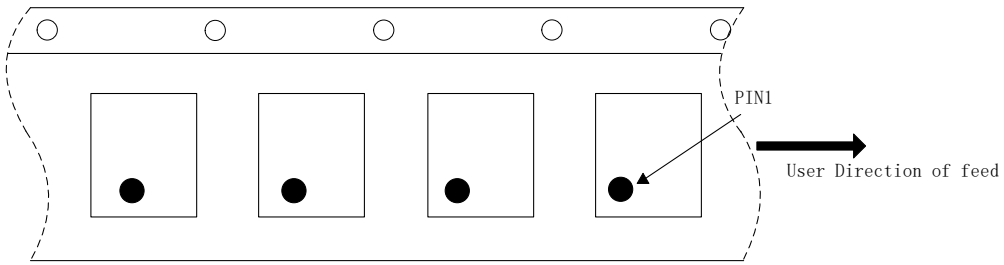
SYMBOL	Dimensions In Millimeters		
	MIN	NOM	MAX
ΦA	176.00	180.00	184.00
W2	10.00	12.00	14.00

TAPE DIMENSIONS



SYMBOL	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.96	1.16	1.36
B	0.96	1.16	1.36
P0	3.80	4.00	4.20
P	1.80	2.00	2.20
D0	1.30	1.50	1.60
W	7.70	8.00	8.30
C	0.30	0.50	0.70

PIN1 AND TAPE FEEDING DIRECTION



Classification of IR Reflow Profile

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak		
Temperature Min(T_{SMIN})	100℃	150℃
Temperature Max(T_{SMAX})	150℃	200℃
Time(T_S) from (T_{SMIN} to T_{SMAX})	60~120 seconds	60~120 seconds
Ramp-up rate (T_L to T_P)	3℃/second max	3℃/second max
Liquidous temperature(T_L)	183℃	217℃
Time(t_L) maintained above T_L	60~150 seconds	60~150 seconds
Peak package body temperature (T_P)	For users T_P must not exceed the Classification temp in Table 1. For suppliers T_P must equal or exceed the Classification temp in Table 1.	For users T_P must not exceed the Classification temp in Table 2. For suppliers T_P must equal or exceed the Classification temp in Table 2.
Time(t_P)* within 5℃ of the specified classification temperature(T_C), see Figure1	20* seconds	30* seconds
Ramp-down rate (T_P to T_L)	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8minutes max
* Tolerance for peak profile temperature (T_P) is defined as a supplier minimum and a user maximum.		

Table 1Sn-Pb Eutectic Process - Classification Temperatures (T_C)

Package Thickness	Volume mm^3 <350	Volume mm^3 ≥350
<2.5mm	235℃	220℃
≥2.5mm	220℃	220℃

Table 2 Pb-Free Process - Classification Temperatures (T_C)

Package Thickness	Volume mm^3 <350	Volume mm^3 350~2000	Volume mm^3 ≥350
<1.6mm	260℃	260℃	260℃
1.6mm~2.5mm	260℃	250℃	245℃
>2.5mm	250℃	245℃	245℃

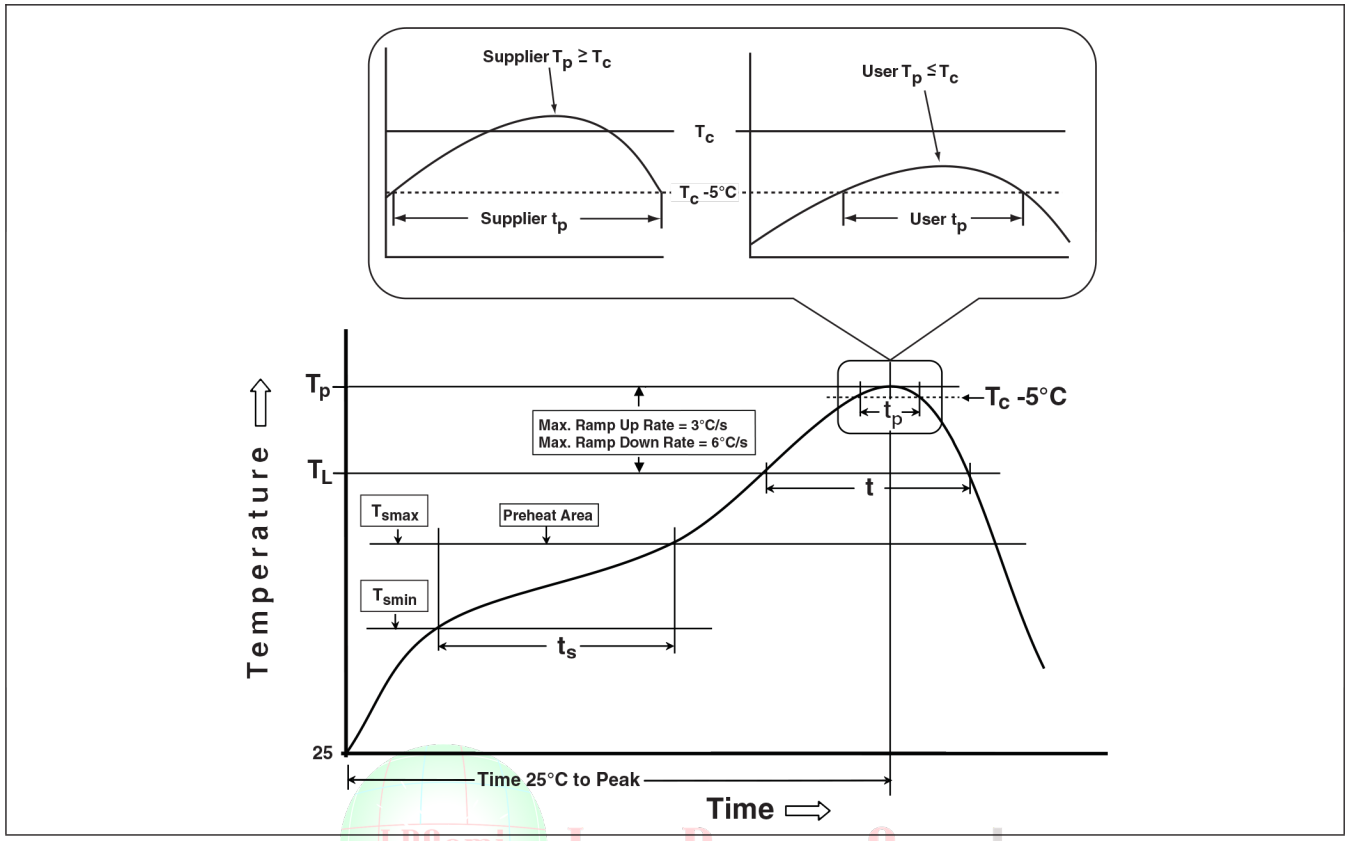


Figure1Classification Profile (Not to scale)

Products conform to "JEDEC J-STD-020C" standards;

Products shipped conform to "Rohs" standards;

Moisture Sensitivity Level：MSL3（CONDITION：≦30 °C/60%RH、Time control:168 hours）;